Notice of Allowability	Application No.	Applicant(s)	
	09/780,303	PANTER ET AL.	
	Examiner	Art Unit	
	Stuart Hendrickson	1754	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *Board Decision 12/15/06*.

2. ☒ The allowed claim(s) is/are *1-7,18 and 19*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☒ Examiner's Amendment/Comment
8. ☐ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Please cancel claims 8-17, 20-27.

Any inquiry concerning this communication should be directed to examiner Hendrickson at telephone number (571) 272-1351.

Stuart Hendrickson
examiner Art Unit 1754

from Brief.
SUM

12. APPENDIX

1. A method for making carbon fibers, the method including the steps of:

providing a precursor fiber;

providing a furnace configured to heat the fiber;

stabilizing the precursor fiber by heating the precursor fiber in an oxidizing environment in a heating chamber of the furnace while applying tension to the precursor fiber;

carbonizing the stabilized fiber by further heating the fiber in an oxidizing environment in the heating chamber of the furnace.

2. The method of claim 1 in which the steps of stabilizing and carbonizing each include:

continuously introducing ambient air into the furnace;

heating the air; and

blowing the heated air over the fiber in the heating chamber of the furnace.

3. The method of claim 1 in which the step of stabilizing includes:

initially heating the precursor fiber until reaching a heating chamber temperature of between approximately 174 and 185 degrees Celsius;

holding the heating chamber at this temperature for approximately 5 minutes until the material begins to stabilize;

after the precursor material begins to stabilize, raising the heating chamber temperature approximately 1.7-2.8 degrees Celsius per minute to approximately 204 degrees

Celsius by increasing the temperature of the heated air being blown into the heating chamber; then

gradually raising the heating chamber temperature from approximately 204 degrees Celsius to approximately 227 to 232 degrees Celsius by increasing the temperature of the heated air being blown into the heating chamber at a rate sufficient for stabilization but insufficient for carbonization; and

the step of carbonizing includes:

quickly raising the heating chamber temperature to approximately 399 degrees Celsius by increasing the temperature of the air being introduced into the heating chamber at a rate that will carbonize the fiber.

4. The method of claim 1 in which the step of carbonizing includes carbonizing the fibers such that each resulting fiber is a biregional fiber that includes an inner non-carbonized core and an exterior carbonized sheath.

5. The method of claim 4 in which:

the step of providing precursor fibers includes providing a homogeneous polymeric material;

the step of stabilizing includes oxygen stabilizing an outer fiber portion of the polymeric material; and

the step of carbonizing includes forming a carbonized outer region and a non-carbonized inner region of each fiber.

6. The method of claim 5 in which the step of providing a homogeneous polymeric material includes providing a standard acrylic polymer.

7. The method of claim 1 in which the step of providing a precursor fiber includes providing a polyacrylonitrile (PAN) fiber.

8. A method for making carbon fibers, the method including the steps of:

providing a precursor fiber;

providing a furnace configured to heat the fiber for both stabilization and carbonization of the fiber; and

stabilizing and carbonizing the fiber in a single continuous process that includes drawing the fiber continuously through the furnace by engaging and applying a continuous pulling force to the fiber from outside the furnace.

9. A method for making carbon fibers, the method including the steps of:

providing an elongated precursor fiber;

providing a plurality of furnaces disposed adjacent one another in a serial side-by-side relationship and configured to heat the fiber to different respective temperatures as the fiber is drawn through the furnaces;

stabilizing the precursor fiber by heating the precursor fiber in an oxidizing environment as it is drawn through respective heating chambers of an initial group of the

plurality of furnaces while applying tension to the precursor fiber; and

continuously carbonizing the stabilized fiber by further heating the fiber in an oxidizing environment as it is drawn through the heating chamber of a final one of the plurality of furnaces.

10. The method of claim 9 in which the step of stabilizing the precursor fiber includes:

heating the heating chamber of a first one of the plurality of furnaces to a first temperature;

heating the heating chamber of each subsequent furnace to a temperature higher than each respective preceding furnace;

heating the heating chamber of one of the furnaces to a temperature less than and approximating the flash point of the precursor fiber being stabilized; and

drawing the fiber through the heating chambers of the furnaces starting with the heating chamber of the first furnace.

11. The method of claim 10 in which the step of providing a plurality of furnaces includes configuring the furnaces such that the fiber is exposed to a temperature just below and approximating the flash point of the fiber for a longer period of time than the fiber spends at the other temperatures.

12. The method of claim 11 in which the step of providing a plurality of furnaces includes:

providing an additional furnace adjacent the furnace that is heated to a

temperature just below the flash point of the precursor fiber being stabilized;

heating the additional furnace to a temperature just below and approximating the flash point of the precursor fiber being stabilized; and

drawing the fiber through the furnaces such that the fiber passes through the heating chamber of the additional furnace after leaving the heating chamber of the furnace that is heated to just below and approximating the flash point of the fiber.

13. The method of claim 9 in which the step of carbonizing the fiber includes:

heating the heating chamber of a final one of the furnaces to a temperature that will carbonize at least a portion of the fiber; and

drawing the fiber through the heating chamber of the final furnace.

14. The method of claim 9 in which:

the step of providing a plurality of furnaces includes providing seven furnaces connected in series; and

the step of stabilizing the precursor fiber includes:

heating the heating chamber of the first furnace to approximately 185 degrees Celsius;

heating the heating chamber of the second furnace to approximately 193 degrees Celsius;

heating the heating chamber of the third furnace to approximately 204 degrees Celsius;

heating the heating chamber of the fourth furnace to approximately 216 degrees Celsius;

heating the heating chambers of the fifth and sixth furnaces to approximately 232 degrees Celsius; and

drawing the fiber through the heating chambers of the first, second, third, fourth, fifth, sixth, and seventh furnaces in sequence.

15. The method of claim 14 in which the step of carbonizing the fiber includes:

heating the heating chamber of the seventh furnace to approximately 260 degrees Celsius; and

drawing the fiber through the heating chamber of the seventh furnace.

16. The method of claim 14 including the additional step of drawing the fiber through the furnace heating chambers at a rate that provides a residence time in each furnace of approximately 0.6 minutes.

17. The method of claim 15 including the additional step of introducing ambient air into each furnace.

18. A method for making carbon fibers, the method including the steps of:

providing an elongated precursor fiber;

providing at least seven furnaces disposed adjacent one another in a serial

side-by-side relationship, connected in series, and configured to heat the fiber to different respective temperatures as the fiber is drawn through the furnaces;

introducing ambient air into each furnace;

heating the heating chamber of the first furnace to approximately 185 degrees Celsius;

heating the heating chamber of the second furnace to approximately 193 degrees Celsius;

heating the heating chamber of the third furnace to approximately 204 degrees Celsius;

heating the heating chamber of the fourth furnace to approximately 216 degrees Celsius;

heating the heating chambers of the fifth and sixth furnaces to approximately 232 degrees Celsius; and

stabilizing the precursor fiber by heating the precursor fiber in an oxidizing environment as it is drawn through the respective heating chambers of the first, second, third, fourth, fifth, and sixth furnaces in sequence while applying tension to the precursor fiber;

heating the heating chamber of the seventh furnace to approximately 260 degrees Celsius;

continuously carbonizing the stabilized fiber by further heating the fiber in an oxidizing environment as it is drawn through the heating chamber of the seventh furnace; and

adjusting downward the amount of ambient air introduced into furnaces that

are operating at and above approximately 232 degrees Celsius.

19. The method of claim 18 including the additional step of restricting the airflow in furnaces operating at and above 232 degrees Celsius to approximately 60 percent (by volume) of the airflow in the furnaces operating below 232 degrees Celsius.

20. The method of claim 9 including the additional step of further graphitizing the fiber by adding additional furnaces operating at higher temperatures.

21. The method of claim 9 including the additional step of adjusting fiber draw rate to optimize the stabilization and carbonization processes.

22. The method of claim 9 in which:

the step of providing a plurality of furnaces includes spacing apart at least two adjacent ones of the furnaces; and

including the additional step of exposing the fiber to ambient air between the spaced-apart furnaces.

23. The method of claim 9 in which:

the step of providing a plurality of furnaces includes spacing apart at least two adjacent ones of the furnaces; and

including the additional step of enclosing the fiber as it passes between

adjacent ones of the furnaces.

24. The method of claim 9 including the additional step of controlling the degree of carbonization of the fiber by adjusting the residence time within the furnaces.

25. The method of claim 9 including the additional step of forming a biregional fiber having an outer carbonized region and an inner virgin material region by carbonizing only an outer portion of the fiber.

26. The method of claim 25 in which the step of providing a precursor fiber includes providing a bipolymeric fiber containing an inner core of one polymer and an outer sheath of a second polymer that can be carbonized.

27. The method of claim 9 in which the step of providing a precursor fiber includes providing a polyacrylonitrile (PAN) type fiber.